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Bibliography

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4D075 AC06 AC78 AC86 EA60 EC43

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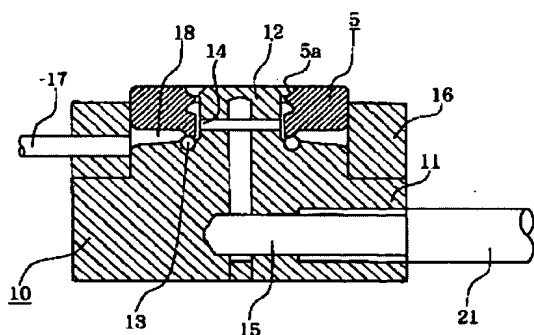
## An epitome

### (57) [Abstract]

[Technical problem] Provide shaft orientations with the oil repellent agent coater with which a bore applies an oil repellent agent to homogeneity automatically at the bearing component part which has the variant bore section which is changing in nonlinear.

[Means for Solution] It constituted from a spreading arm head 10 which applies an oil repellent agent to variant bore section 5a of the bearing component part 5 for an oil repellent agent coater, and an oil repellent agent feeder 20 which carries out constant feeding of the oil repellent agent to the spreading arm head 10. and soffit side 5c of the pillar-shaped height 12 and the bearing component part 5 which is equipped with the delivery 14 of a radial direction for the spreading arm head 10, and separates variant bore section 5a and a predetermined crevice, and fits in -- liquid -- while constituting from a main part member 11 equipped with O ring 13 which is the taking-a-seat section which sits down densely, and an attachment component 16 which holds the bearing component part 5 from an outside The flow way 15 which leads an oil repellent agent from the oil repellent agent feeder 20 to a delivery 14 was formed in the main part member 11.

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## CLAIMS

### [Claim(s)]

[Claim 1] In an oil repellent agent coater with which a bore of shaft orientations consists of an oil repellent agent feeder which carries out constant feeding of the oil repellent agent to a spreading arm head which applies an oil repellent agent to said variant bore section of a bearing component part which has the variant bore section which is changing in nonlinear, and said spreading arm head a soffit side of a pillar-shaped height

which said spreading arm head is equipped with a delivery of a radial direction, and separates the variant bore section and a predetermined crevice between said bearing component parts, and fits in, and said bearing component part -- liquid -- with a main part member equipped with the taking-a-seat section which sits down densely. An oil repellent agent coater characterized by consisting of attachment components which hold said bearing component part from an outside, and forming in said main part member a flow way which leads an oil repellent agent from said oil repellent agent feeder to said delivery.

[Claim 2] It is the oil repellent agent coater of claim 1 characterized by for said pillar-shaped height being a cylinder projection, and said taking-a-seat section being an O ring.

[Claim 3] An oil repellent agent coater of claim 1 characterized by forming a blowdown means in said attachment component.

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**DETAILED DESCRIPTION**

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the oil repellent agent coater which applies an oil repellent agent to the bearing component part whose part which should apply an oil repellent agent it is the bearing component part of a fluid hydrodynamic bearing, and is a complicated configuration automatically.

[0002]

[Description of the Prior Art] Generally a shaft, a sleeve, and the lubricating oil with which the minute crevice formed between these bearing configuration members was filled up are provided. And it sets to the fluid hydrodynamic bearing which the seal was carried out and consisted of the capillary tube seal sections. In order to hold a lubricating oil in the minute crevice in which the dynamic pressure generating slot is established in said minute crevice, i.e., the dynamic pressure generating section, and to make it a lubricating oil not leak out from the capillary tube seal section, the oil repellent agent is applied to the predetermined part of a bearing configuration member.

[0003] for example, to JP,58-50321,A It has the lubricating oil filled between \*\*\*\* of the parallel which were formed in either or the both sides of two front faces which carry out relative motion, and these front faces, and inclined to the direction of relative movement, and two front faces. The gap of two members which have each of said two front faces is formed so that the neighborhood in which said \*\*\*\* was formed may become the narrowest. Said lubricating oil is made to trespass only upon the neighborhood in which this \*\*\*\* was formed of the force of the capillarity between said two members, and is held, and the fluid hydrodynamic bearing which applied the oil repellent agent on said one [ at least ] two surface extension is indicated. That is, the fluid hydrodynamic bearing by which the oil repellent agent is applied to the predetermined part of the bearing configuration member which forms the capillary tube seal section is indicated so that a lubricating oil may not leak out from a capillary tube seal.

[0004] By the way, since spreading of this oil repellent agent is performed manually, applying an oil repellent agent with a sufficient location precision to the inclined plane which is the predetermined part of the bearing configuration member which forms the capillary tube seal section has the problem of being difficult. This spreading becomes difficult, so that the fluid hydrodynamic bearing of a motor is miniaturized or an appearance becomes complicated. Then, in order to solve this problem, the two following solution means are proposed.

[0005] 1st conventional solution means to solve the difficulty of applying an oil repellent agent to the predetermined part of the bearing configuration member which forms a capillary tube seal with a sufficient

location precision It is what is adopted as the fluid hydrodynamic bearing of the disclosure to JP,10-73126,A. It is made not to use an oil repellent agent for the capillary tube seal section formed in the crevice between the upper part of a shaft, and the inner skin of a thrust presser-foot board by preparing at the perimeter the corner which has an oil-repellent function in the part outside a gas-liquid interface. Although this is a solution means essential to be sure, in order to obtain the oil-repellent function which is equal to an oil repellent agent, it must specify the size and structure of bearing, and cannot adopt them as the fluid hydrodynamic bearing of various classes or size.

[0006] 2nd conventional solution means to solve the difficulty of applying an oil repellent agent to the predetermined part of the bearing configuration member which forms a capillary tube seal with a sufficient location precision It is what is adopted as the fluid hydrodynamic bearing which uses the shaft and sleeve of disclosure as a bearing configuration member at JP,8-140304,A. The oil repellent agent of the portion which should apply an oil repellent agent to the whole bearing configuration member first, and should apply an oil repellent agent after that and which does not come out, i.e., the portion which forms the dynamic pressure generating section, and the portion which forms the capillary tube seal section is removed. An oil repellent agent is removed from the part in which impregnation of the whole shaft member is carried out to an oil repellent agent, an oil repellent agent is more specifically applied to all the front faces, a dynamic pressure generating slot is formed in the predetermined part of the peripheral face of a shaft member by plastic working or cutting by the press after that, and the taper slot of the capillary tube seal section is also formed in by cutting, and forms the dynamic pressure generating section and the capillary tube seal section by this. Similarly, impregnation of the whole sleeve member is carried out to an oil repellent agent, an oil repellent agent is applied to all the front faces, the dynamic pressure generating section is formed in the predetermined part of the inner skin of a sleeve member by cutting after that, and an oil repellent agent is removed.

[0007] According to the above-mentioned conventional 2nd solution means, the time and effort of spreading of an oil repellent agent is substantially reducible. However, this conventional 2nd solution means has a problem of a waste of the oil repellent agent of being applied to the portion which does not need spreading of an oil repellent agent in a bearing configuration member, i.e., the portion which is large surface area overwhelmingly. Moreover, since cutting oil is used when forming a dynamic pressure generating slot and the taper slot of the capillary tube seal section by cutting, the oil repellent agent applied with cutting oil becomes dirty, or the nonconformity removed from a required part also has the oil repellent agent applied at the degreasing process of the bearing configuration member after cutting.

[0008]

[Problem(s) to be Solved by the Invention] The technical problem which this invention tends to solve is the bearing component part of a fluid hydrodynamic bearing, and is providing the bearing component part which has the variant bore section from which the bore's is changing to shaft orientations in nonlinear with the oil repellent agent coater which applies an oil repellent agent to homogeneity automatically.

[0009]

[Means for Solving the Problem] It constituted from a spreading arm head which applies an oil repellent agent to said variant bore section of a bearing component part which has the variant bore section from which a bore of shaft orientations is changing in nonlinear an oil repellent agent coater of claim 1 which solves the above-mentioned technical problem, and an oil repellent agent feeder which carries out constant feeding of the oil repellent agent to said spreading arm head. and a soffit side of a pillar-shaped height which is equipped with a delivery of a radial direction for said spreading arm head, and separates the variant bore section and a predetermined crevice between said bearing component parts, and fits in, and said bearing component part -- liquid -- while constituting from a main part member equipped with the taking-a-seat section which sits down densely, and an attachment component which holds said bearing component part from an outside, a flow way which leads an oil repellent agent from said oil repellent agent feeder to said delivery was formed in said main part member.

[0010] In an oil repellent agent coater of claim 1, said pillar-shaped height was considered for an oil repellent agent coater of claim 2 which solves the above-mentioned technical problem as a cylinder projection, and said taking-a-seat section was constituted as an O ring.

[0011] In an oil repellent agent coater of claim 1, in said attachment component, a blowdown means was established and an oil repellent agent coater of claim 3 which solves the above-mentioned technical problem was constituted.

[0012]

[Embodiment of the Invention] The oil repellent agent coater which is 1 operation gestalt of this invention consists of spreading arm heads 10a, 10b, 10c, 10d, and 10e and an oil repellent agent feeder 20 which carries

out constant feeding of the oil repellent agent to these spreading arm heads 10a-10e, as shown to drawing 1 in a block diagram.

[0013] Supply pipe 21a by which, as for the oil repellent agent feeder 20, the end was connected to the spreading arm heads 10a-10e, respectively, 21b, 21c, 21d, 21e, the pump 22 by which the other end of these supply pipes 21a-21e was connected to that exhaust port, the oil repellent agent storage tank 24 connected to the inlet of this pump through the pipe 23, the solenoid valves 25a, 25b, and 25c arranged in the middle of supply pipes 21a-21e, respectively. It consists of 25d, 25e, and closing motion of these solenoid valves 25a-25e and the control unit 26 which controls operation of a pump 22.

[0014] The bore of shaft orientations is the ring-like bearing component part 5 which has variant bore section 5a which is changing in nonlinear, and the bearing component parts to which an oil repellent agent is applied by the oil repellent agent coater concerning this invention are components with which an oil repellent agent is applied to variant bore section 5a, as shown in drawing 2. In addition, 5b, 5c, and 5d are the peripheral faces, upper bed sides, and soffit sides of the ring-like bearing component part 5, respectively.

[0015] The spreading arm heads 10a-10e consist of a main part member 11 in which all have the pillar-shaped height 12 and the taking-a-seat section 13, and a ring-like attachment component 16 which holds the bearing component part 5 from an outside, as shown in drawing 3. The pillar-shaped height 12 is a cylinder projection, and length is set to the bore list so that variant bore section 5a of the bearing component part 5 and a predetermined crevice may be separated and it may fit in. The delivery 14 is formed below the medium of the shaft orientations at the pillar-shaped height 12. As for a delivery 14, it is desirable to be arranged [ two or more ] at equal intervals in a radial direction. the time of installing the bearing component part 5 in a spreading arm head -- that soffit side 5b -- liquid -- the taking-a-seat section 13 which sits down densely is an O ring, and this O ring 13 is contained by the circular sulcus formed in the perimeter of the soffit section of the pillar-shaped height 12. The flow way 15 which leads the oil repellent agent from the oil repellent agent feeder 20 to a delivery 14 is formed in the main part member 11. Moreover, exhaust passage 17 is formed in the ring-like attachment component 16.

[0016] Next, the oil repellent agent spreading activity to the bearing component part 5 by the oil repellent agent coater shown in drawing 1 is explained. As for a preparatory work, authorized personnel install the bearing component part 5 in the spreading arm heads 10a-10e first. The conditions that this preparatory work was completed are the cross section of drawing 4, and the perspective diagram of drawing 5. namely, variant bore section 5a to which, as for the bearing component part 5, an oil repellent agent is applied -- the pillar-shaped height 12 -- fitting in -- and the soffit side 5b -- the taking-a-seat section 13 -- liquid -- as it sits down densely, it is installed in the main part member 11 of the spreading arm heads 10a-10e, and the peripheral face is further held by the ring-like attachment component 16.

[0017] The oil repellent agent stored in the tank 24 is fed through each supply pipe 21a-21e by the spreading arm heads 10a-10e in which the bearing component part 5 was installed through the preparatory work. The fed oil repellent agent is breathed out from a delivery 14 through the flow way 15 currently drilled in the main part member 11. The breathed-out oil repellent agent fills thoroughly the crevice currently formed between variant bore section 5a and the peripheral face of the pillar-shaped projection 12, and it becomes to the extent that it almost overflows from the up opening of this crevice. If this condition is reached, supply of an oil repellent agent will stop and the bearing component part 5 will be removed from the spreading arm heads 10a-10e by authorized personnel. Although, as for the removed bearing component part, the oil repellent agent of an excess remains in the variant bore section 5a, this is removed by shaking off. Thus, an oil repellent agent is automatically applied to homogeneity at variant bore section 5a of the bearing component part 5.

[0018] The constant feeding of the oil repellent agent to the spreading arm heads 10a-10e is controlled by the control unit 26. That is, a control unit 26 controls closing motion of the solenoid valves 25a-25e arranged in the middle of 21a-21e, respectively, and controls supply and a halt of the oil repellent agent to the spreading arm heads 10a-10e while it controls operation of the pump 22 for feeding an oil repellent agent from the oil repellent agent storage tank 24 to supply pipes 21a-21e. In addition, since the space 18 between the upper surface of the main part member 11 of the spreading arm heads 10a-10e and the inner skin of an attachment component 16 was covered with the oil repellent agent when spreading was repeated several times, it decided to discharge this with an exhaust pipe 17.

[0019] Furthermore, the fluid hydrodynamic bearing equipped with the bearing component part to which the oil repellent agent was applied by the oil repellent agent coater concerning this invention is explained. This fluid hydrodynamic bearing is what was indicated in these people's Japanese Patent Application No. No. 082280 [ 11 to ], and consists of a shaft 1 with a flange which consists of a ring member 3 and a cylinder member 2, a sleeve 4 which receives this shaft 1 with a flange, and annular covering device material 5 which functions also

as a thrust presser-foot member. the body of the byway where a sleeve 4 has a bottom in the lower berth -- and the body of the major diameter which has the opening edge which carried out the opening to atmospheric air is formed in the upper case, respectively. The annular step is formed in the opening edge of a sleeve 4, the annular covering device material 5 is pressed fit in this annular step, and the opening edge of a sleeve 4 is closed by this. A radial dynamic pressure generating slot is for example, a herringbone slot, and is formed in the peripheral face of the cylinder member 2 bottom. Moreover, a thrust dynamic pressure generating slot is a herringbone slot on the spiral, and is formed in the upper surface and the underside of the ring member 3, respectively.

[0020] Several micrometers to about several 10 micrometers [ which was formed between the shaft 1 with a flange, a sleeve 4, and the annular covering device material 5 ] minute crevices R1, R2, R3, R4, and R5 are filled up with the lubricating oil F. The seal of a lubricating oil F is performed by the capillary tube seal S1 of the lower berth, and S2 of an upper case. The 1st capillary tube seal S1 forms several 10 to about several 100 micrometers minute annular clearance between the lower-berth inner skin of the byway of the annular covering device material 5, and the peripheral face of the cylinder section 2 of the shank material 1 with a flange, and makes lower-berth inner skin of the annular covering device material 5 the shape of a taper. The 2nd capillary tube seal S2 forms several 10 to about several 100 micrometers minute annular clearance between the upper case inner skin of the major diameter of the annular covering device material 5, and peripheral face 6b of the annular lobe of the hub 6 pressed fit in the cylinder section 2 of the shank material 1 with a flange, and makes upper case inner skin of the major diameter of the annular covering device material 5 the shape of a taper. The annular covering device material 5 is a bearing component part with which the bore of shaft orientations has the variant bore section which is changing in nonlinear in this way, and the oil repellent agent is applied to this variant bore section.

[0021] The annular space W for buffers is formed between the 1st capillary tube seal S1 and the 2nd capillary tube seal S2. Therefore, the seal structures of this fluid hydrodynamic bearing are the 1st capillary tube seal S1 of the lower berth, the 2nd capillary tube seal S2 of an upper case, and the three-steps structure of the annular space W for buffers of the middle. Namely, the 1st capillary tube seal S1 of the lower berth serves as an annular taper slot which carried out the opening to breadth at last toward the annular space W for buffers, and, as for the lubricating oil with which it filled up in the fluid hydrodynamic bearing, the break through to the annular space W for buffers is prevented by capillarity and surface tension.

[0022] When the lubricating oil with which a rapid thermal expansion and a big impact were filled up in the fluid hydrodynamic bearing overflows the 1st capillary tube seal S1 of the lower berth, it prevents that the annular space W for buffers holds the overflowed lubricating oil, and leaks it outside. When the lubricating oil of a large quantity overflows so that the annular space W for buffers cannot be held, the 2nd capillary tube seal S2 of an upper case prevents that a lubricating oil leaks out besides a fluid hydrodynamic bearing with capillarity and surface tension. Thus, the annular covering device material 5 whose bore of shaft orientations is the bearing component part which has the variant bore section which is changing in nonlinear is adopted as realizing seal structure of preventing a break through of a lubricating oil in three steps.

[0023] As mentioned above, although 1 operation gestalt equipped with five spreading arm heads for the oil repellent agent coater concerning this invention was indicated and being explained to details, as for the number of spreading arm heads, it is needless to say that it can fluctuate if needed. Moreover, you may be the thing of other configurations without being limited to what also indicated the weight or volumetric or counting feeder 20 of an oil repellent agent to drawing 1 . Furthermore, the bearing component part to which an oil repellent agent is applied by the oil repellent agent coater concerning this invention is not limited to the \*\*\*\* components which may be what kind of components as long as the bore of shaft orientations is the bearing component part which has the variant bore section which is changing in nonlinear, and were shown in drawing 2 or drawing 6 .

[0024]

[Effect of the Invention] By using the oil repellent agent coater concerning this invention, the efficiency of the oil repellent agent spreading activity to the bearing component part which has the variant bore section from which the bore of shaft orientations is changing in nonlinear, and the quality of spreading improved. Namely, an oil repellent agent can be applied now to quick and homogeneity to the bearing component part of a large quantity. Therefore, reduction of the manufacturing cost of a fluid hydrodynamic bearing and improvement in quality were achieved by using the bearing component part with which the oil repellent agent was applied by this invention.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

**[Drawing 1]** It is the block diagram showing the configuration of the oil repellent agent coater of 1 operation gestalt of this invention.

**[Drawing 2]** The bore of shaft orientations is the cross section of the bearing component part which has the variant bore section which is changing in nonlinear.

**[Drawing 3]** It is the cross section of 1 operation gestalt of a spreading arm head.

**[Drawing 4]** It is the cross section of 1 operation gestalt of a spreading arm head in which the bearing component part which has the variant bore section was installed.

**[Drawing 5]** It is the perspective diagram of 1 operation gestalt of a spreading arm head in which the bearing component part which has the variant bore section was installed.

**[Drawing 6]** It is the cross section of 1 operation gestalt of the fluid hydrodynamic bearing equipped with the bearing component part which has the variant bore section. However, the minute crevice is exaggerated and shown.

**[Description of Notations]**

1 Shaft with Flange

2 Cylinder Member

3 Ring Member

4 Sleeve

5 Bearing Component Part or Annular Covering Device Material

5a Variant bore section

5b, 5c, and 5d The peripheral face, upper bed side, and soffit side of the bearing component part 5

6 Cup-like Hub

R1, R2, R3, R4, R5 Minute crevice

F Lubricating oil

10, 10a-10e Spreading arm head

11 Main Part Member

12 Pillar-shaped Height or Cylinder Projection

13 Taking-a-Seat Section or O Ring

14 Delivery

15 Flow Way

16 Attachment Component

17 Exhaust Passage

18 Space

20 Oil Repellent Agent Feeder

21, 21a-21e Supply pipe

22 Pump

23 Pipe

24 Tank

25a-25e Solenoid valve

26 Control Unit

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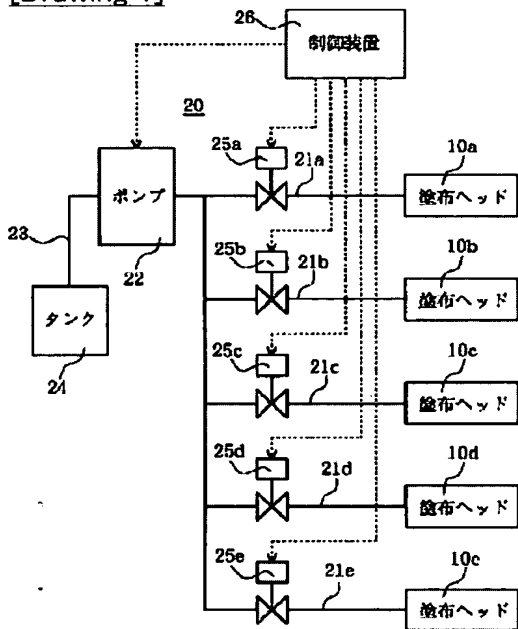
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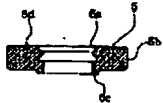
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## DRAWINGS

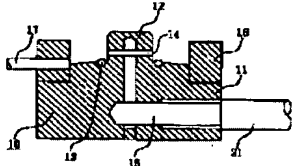
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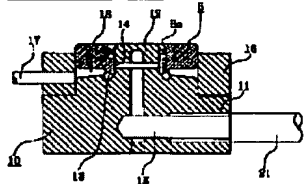
[Drawing 2]



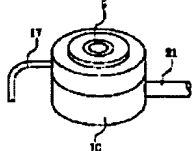
[Drawing 3]



[Drawing 4]

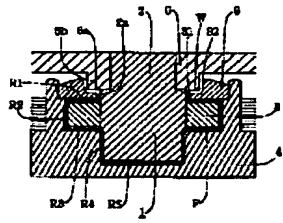


[Drawing 5]



[Drawing 6]





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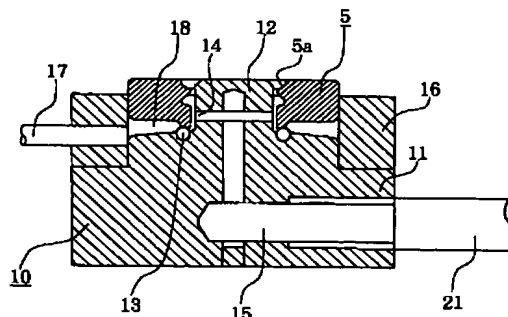
F ターム (参考) 4D075 AC06 AC78 AC86 EA60 EC43

(54) 【発明の名称】 撥油剤塗布装置

(57) 【要約】

【課題】 軸方向に内径が非直線的に変化している異形内径部を有する軸受構成部品に撥油剤を自動的に且つ均一に塗布する撥油剤塗布装置を提供すること。

【解決手段】 撥油剤塗布装置を、軸受構成部品5の異形内径部5aに撥油剤を塗布する塗布ヘッド10と、塗布ヘッド10に撥油剤を定量供給する撥油剤供給装置20とで構成した。そして、塗布ヘッド10をラジアル方向の吐出口14を備え且つ異形内径部5aと所定隙間を隔てて嵌合する柱状突起部12と軸受構成部品5の下端面5cが液密に着座する着座部であるリング13とを備えた本体部材11と、軸受構成部品5を外側から保持する保持部材16とで構成すると共に、本体部材11には撥油剤供給装置20からの撥油剤を吐出口14に導く導通路15を形成した。



## 【特許請求の範囲】

【請求項 1】 軸方向の内径が非直線的に変化している異形内径部を有する軸受構成部品の前記異形内径部に撥油剤を塗布する塗布ヘッドと前記塗布ヘッドに撥油剤を定量供給する撥油剤供給装置とからなる撥油剤塗布装置において、前記塗布ヘッドは、ラジアル方向の吐出口を備え且つ前記軸受構成部品の異形内径部と所定隙間を隔てて嵌合する柱状突起部と前記軸受構成部品の下端面が液密に着座する着座部とを備えた本体部材と、前記軸受構成部品を外側から保持する保持部材とから構成され、前記本体部材には前記撥油剤供給装置からの撥油剤を前記吐出口に導く導通路が形成されていることを特徴とする撥油剤塗布装置。

【請求項 2】 前記柱状突起部は円柱突起であり、且つ前記着座部は O リングであることを特徴とする請求項 1 の撥油剤塗布装置。

【請求項 3】 前記保持部材には、排出手段が設けられていることを特徴とする請求項 1 の撥油剤塗布装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、流体動圧軸受の軸受構成部品であって撥油剤を塗布すべき部位が複雑な形状である軸受構成部品に撥油剤を自動的に塗布する撥油剤塗布装置に関する。

## 【0002】

【従来の技術】一般に、シャフトと、スリーブと、これら軸受構成部材間に形成された微小隙間に充填された潤滑油とを具備し、且つキャピラリーシール部でシールされて構成された流体動圧軸受においては、前記微小隙間の中で動圧発生溝が設けられている微小隙間、即ち動圧発生部に潤滑油を保持し、且つキャピラリーシール部から潤滑油が漏出しないようにするために軸受構成部材の所定部位に撥油剤が塗布されている。

【0003】例えば、特開昭 58-50321 号公報には、相対運動をする二つの表面、これら表面のいずれか一方もしくは双方に形成されかつその相対運動の方向に対して傾いた平行の溝群及び二つの表面の間に満たされた潤滑油を有し、前記二つの表面のそれぞれを有する二つの部材の間隔を、前記溝群が形成された付近が最も狭くなるよう形成し、前記潤滑油を前記二つの部材間の毛細管現象の力によってこの溝群が形成された付近だけに侵入させ保持し、前記二つの表面の少なくとも一方の延長上に撥油剤を塗布した流体動圧軸受が開示されている。即ち、キャピラリーシールから潤滑油が漏出ないように、キャピラリーシール部を形成している軸受構成部材の所定の部位に撥油剤が塗布されている流体動圧軸受が開示されている。

【0004】ところで、この撥油剤の塗布は手作業で行われるため、キャピラリーシール部を形成する軸受構成部材の所定部位である傾斜面に対して撥油剤を位置精度

良く塗布することは困難であるという問題がある。この塗布作業は、モータの流体動圧軸受が小型化され、或いは外形が複雑になる程、困難になる。そこで、この問題を解決するために、下記の 2 つの解決手段が提案されている。

【0005】キャピラリーシールを形成する軸受構成部材の所定部位に撥油剤を位置精度良く塗布することの困難性を解決する従来の第 1 の解決手段は、特開平 10-73126 号公報に開示の流体動圧軸受に採用されているもので、シャフトの上部とスラスト押さえ板の内周面との間の隙間に形成されたキャピラリーシール部に、気液界面より外側の部位に撥油機能を有する角部を全周に設けることによって、撥油剤を用いないようにしたものである。これは確かに本質的な解決手段ではあるが、撥油剤に匹敵する撥油機能を得るためには軸受のサイズや構造を特定しなければならず、様々な種類やサイズの流体動圧軸受に採用できるものではない。

【0006】キャピラリーシールを形成する軸受構成部材の所定部位に撥油剤を位置精度良く塗布することの困難性を解決する従来の第 2 の解決手段は、特開平 8-140304 号公報に開示のシャフトとスリーブを軸受構成部材とする流体動圧軸受に採用されているもので、先ず軸受構成部材全体に撥油剤を塗布し、その後に撥油剤を塗布すべきでない部分、即ち動圧発生部を形成する部分とキャピラリーシール部を形成する部分の撥油剤を除去するというものである。より具体的には、シャフト部材全体を撥油剤に含浸させて、その表面全てに撥油剤を塗布し、その後にシャフト部材の外周面の所定の部位に動圧発生溝をプレスによる塑性加工又は切削加工により形成し、またキャピラリーシール部のテーパ溝も切削加工により形成し、これにより動圧発生部とキャピラリーシール部を形成する部位から撥油剤を除去する。同様に、スリーブ部材全体を撥油剤に含浸させて、その表面全てに撥油剤を塗布し、その後にスリーブ部材の内周面の所定の部位に動圧発生部を切削加工により形成し、撥油剤を除去する。

【0007】上記の従来の第 2 解決手段によれば、撥油剤の塗布の手間は大幅に削減できる。しかしながら、この従来の第 2 解決手段は、軸受構成部材において撥油剤の塗布を必要としない部分、即ち圧倒的に広い表面積である部分にまで塗布されるという撥油剤の無駄使いという問題がある。また、切削加工により動圧発生溝やキャピラリーシール部のテーパ溝を形成する場合は切削油が用いられるので、切削油で塗布された撥油剤が汚れたり、或いは切削加工後の軸受構成部材の脱脂工程で塗布された撥油剤が必要な部位から除去される不具合もある。

## 【0008】

【発明が解決しようとする課題】本発明が解決しようとする課題は、流体動圧軸受の軸受構成部品であって、軸

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方向に内径が非直線的に変化している異形内径部を有する軸受構成部品に撥油剤を自動的に且つ均一に塗布する撥油剤塗布装置を提供することである。

#### 【0009】

【課題を解決するための手段】上記課題を解決する請求項1の撥油剤塗布装置を、軸方向の内径が非直線的に変化している異形内径部を有する軸受構成部品の前記異形内径部に撥油剤を塗布する塗布ヘッドと、前記塗布ヘッドに撥油剤を定量供給する撥油剤供給装置とで構成した。そして、前記塗布ヘッドを、ラジアル方向の吐出口を備え且つ前記軸受構成部品の異形内径部と所定隙間を隔てて嵌合する柱状突起部と前記軸受構成部品の下端面が液密に着座する着座部とを備えた本体部材と、前記軸受構成部品を外側から保持する保持部材とで構成すると共に、前記本体部材には前記撥油剤供給装置からの撥油剤を前記吐出口に導く導通路を形成した。

【0010】上記課題を解決する請求項2の撥油剤塗布装置を、請求項1の撥油剤塗布装置において前記柱状突起部を円柱突起とし且つ前記着座部をリングとして構成した。

【0011】上記課題を解決する請求項3の撥油剤塗布装置を、請求項1の撥油剤塗布装置において前記保持部材に排出手段を設けて構成した。

#### 【0012】

【発明の実施の形態】本発明の一実施形態である撥油剤塗布装置は、図1にブロック図で示す如く、塗布ヘッド10a、10b、10c、10d、10eと、これら塗布ヘッド10a～10eに撥油剤を定量供給する撥油剤供給装置20とから構成されている。

【0013】撥油剤供給装置20は、塗布ヘッド10a～10eに一端が夫々接続された供給管21a、21b、21c、21d、21e、これら供給管21a～21eの他端がその排出口に接続されたポンプ22、このポンプの導入口にパイプ23を介して接続された撥油剤貯蔵タンク24、供給管21a～21eの途中に夫々配設された電磁弁25a、25b、25c、25d、25e、及び、これら電磁弁25a～25eの開閉とポンプ22の運転を制御する制御装置26とから構成されている。

【0014】本発明に係る撥油剤塗布装置により撥油剤が塗布される軸受構成部品は、例えば図2に示す如く、軸方向の内径が非直線的に変化している異形内径部5aを有するリング状軸受構成部品5であって、異形内径部5aに撥油剤が塗布される部品である。なお、5b、5c及び5dは夫々リング状軸受構成部品5の外周面、上端面及び下端面である。

【0015】塗布ヘッド10a～10eは、図3に示す如く、いずれも柱状突起部12と着座部13を有する本体部材11と、軸受構成部品5を外側から保持するリング状保持部材16とで構成されている。柱状突起部12

は円柱突起であって、軸受構成部品5の異形内径部5aと所定隙間を隔てて嵌合するように、その内径並びに長さが定められている。柱状突起部12には、その軸方向の中間より下部に吐出口14が形成されている。吐出口14は複数個、ラジアル方向に等間隔に配置されるのが望ましい。軸受構成部品5を塗布ヘッドに設置したときに、その下端面5bが液密に着座する着座部13はリングであって、このリング13は柱状突起部12の下端部の周囲に形成された環状溝に収納されている。撥油剤供給装置20からの撥油剤を吐出口14に導く導通路15は、本体部材11に形成されている。また、リング状保持部材16には、排出路17が形成されている。

【0016】次に、図1に示す撥油剤塗布装置による軸受構成部品5への撥油剤塗布作業を説明する。先ず準備作業は作業員が軸受構成部品5を塗布ヘッド10a～10eに設置する。この準備作業が完了した状態が、図4の断面図及び図5の斜視図である。即ち、軸受構成部品5は、撥油剤が塗布される異形内径部5aを柱状突起部12に嵌合し、且つその下端面5bが着座部13に液密に着座するようにして、塗布ヘッド10a～10eの本体部材11に設置され、更にリング状保持部材16によってその外周面を保持されている。

【0017】準備作業を経て軸受構成部品5が設置された塗布ヘッド10a～10eには、夫々の供給管21a～21eを経て、タンク24に貯蔵されている撥油剤が圧送されてくる。圧送されてきた撥油剤は、本体部材11内に穿設されている導通路15を経て吐出口14から吐出される。吐出された撥油剤は、異形内径部5aと柱状突起12の外周面との間に形成されている隙間を完全に満たし、この隙間の上部開口から殆ど溢れるぐらいになる。この状態に達すると、撥油剤の供給は停止され、軸受構成部品5は作業員によって塗布ヘッド10a～10eから取り外される。取り外された軸受構成部品は、その異形内径部5aに余分の撥油剤が残っているが、これは振り払うことで除去される。このようにして、軸受構成部品5の異形内径部5aには撥油剤が自動的に均一に塗布される。

【0018】塗布ヘッド10a～10eへの撥油剤の定量供給は、制御装置26によって制御されている。即ち、制御装置26は撥油剤貯蔵タンク24から供給管21a～21eへ撥油剤を圧送するためのポンプ22の運転を制御するとともに、21a～21eの途中に夫々配設された電磁弁25a～25eの開閉を制御して、塗布ヘッド10a～10eへの撥油剤の供給と停止を制御する。なお、塗布作業を何回か繰り返すと、塗布ヘッド10a～10eの本体部材11の上面と保持部材16の内周面との間の空間18に撥油剤が溜まってくるので、排出管17でこれを排出することにした。

【0019】更に、本発明に係る撥油剤塗布装置により撥油剤が塗布された軸受構成部品を備えた流体動圧軸受

について説明する。この流体動圧軸受は、本出願人の特願平 11-082280 号において開示したもので、リング部材 3 と円柱部材 2 とからなるフランジ付シャフト 1 と、このフランジ付シャフト 1 を受けるスリーブ 4 と、スラスト押さえ部材としても機能する環状蓋部材 5 とから構成されたものである。スリーブ 4 は、下段には底を有する小径の円筒部が、且つ上段には大径の円筒部が夫々形成されている。スリーブ 4 の開口端には環状段部が形成されており、この環状段部には環状蓋部材 5 が圧入され、これによってスリーブ 4 の開口端は塞がれている。ラジアル動圧発生溝は例えばヘリングボーン溝であって、円柱部材 2 の下側の外周面に形成されている。また、スラスト動圧発生溝は例えばスパイラルのヘリングボーン溝であって、リング部材 3 の上面と下面に夫々形成されている。

【0020】フランジ付シャフト 1、スリーブ 4 及び環状蓋部材 5 との間に形成された数  $\mu\text{m}$  から数  $10\mu\text{m}$  程度の微小隙間 R1、R2、R3、R4 及び R5 には、潤滑油 F が充填されている。潤滑油 F のシールは下段のキャピラリーシール S1 と上段の S2 とによって行われている。第 1 のキャピラリーシール S1 は、環状蓋部材 5 の小径の下段内周面とフランジ付軸部材 1 の円柱部 2 の外周面との間に数  $10\mu\text{m}$  から数  $100\mu\text{m}$  程度の微小な環状隙間を形成し、且つ環状蓋部材 5 の下段内周面をテーパ状としたものである。第 2 のキャピラリーシール S2 は、環状蓋部材 5 の大径の上段内周面とフランジ付軸部材 1 の円柱部 2 に圧入されたハブ 6 の環状突出部の外周面 6b との間に数  $10\mu\text{m}$  から数  $100\mu\text{m}$  程度の微小な環状隙間を形成し、且つ環状蓋部材 5 の大径の上段内周面をテーパ状としたものである。環状蓋部材 5 は、このように、軸方向の内径が非直線的に変化している異形内径部を有する軸受構成部品であって、この異形内径部には撥油剤が塗布されている。

【0021】第 1 のキャピラリーシール S1 と第 2 のキャピラリーシール S2 との間にはバッファ用環状空隙 W が形成されている。従って、この流体動圧軸受のシール構造は、下段の第 1 のキャピラリーシール S1 と、上段の第 2 のキャピラリーシール S2、及び中段のバッファ用環状空隙 W の三段構え構造である。即ち下段の第 1 のキャピラリーシール S1 は、バッファ用環状空隙 W に向かって末広がりに開口した環状のテーパ溝となっており、流体動圧軸受内に充填された潤滑油は毛細管現象と表面張力によってバッファ用環状空隙 W への漏出が阻止される。

【0022】もし、急激な熱膨張や大きな衝撃によって流体動圧軸受内に充填された潤滑油が下段の第 1 のキャピラリーシール S1 から溢れ出した場合、バッファ用環状空隙 W は溢れ出した潤滑油を收容し、外に漏出するのを防止する。バッファ用環状空隙 W が收容しきれない程に大量の潤滑油が溢れ出した場合には、上段の第 2

のキャピラリーシール S2 が毛細管現象と表面張力によって流体動圧軸受の外に潤滑油が漏出するのを阻止する。このように三段構えで潤滑油の漏出を防止するシール構造を実現するのに採用されているのが、軸方向の内径が非直線的に変化している異形内径部を有する軸受構成部品である環状蓋部材 5 である。

【0023】以上、本発明に係る撥油剤塗布装置を 5 個の塗布ヘッドを備えた一実施形態を開示して詳細に説明したが、塗布ヘッドの数は必要に応じて増減できることは勿論である。また、撥油剤の定量供給装置 20 も図 1 に開示したものに限定されないで、他の構成のものであってもよい。更に、本発明に係る撥油剤塗布装置により撥油剤が塗布される軸受構成部品は、軸方向の内径が非直線的に変化している異形内径部を有する軸受構成部品であればどのような部品であってもよく、図 2 又は図 6 に示した如き部品に限定されるものではない。

#### 【0024】

【発明の効果】本発明に係る撥油剤塗布装置を用いることによって、軸方向の内径が非直線的に変化している異形内径部を有する軸受構成部品への撥油剤塗布作業の能率と塗布の品質が向上した。即ち、大量の軸受構成部品に対して迅速且つ均一に撥油剤の塗布が行えるようになった。従って、本発明により撥油剤が塗布された軸受構成部品を用いることによって、流体動圧軸受の製造コストの低減と品質の向上が図られた。

#### 【図面の簡単な説明】

【図 1】 本発明の一実施形態の撥油剤塗布装置の構成を示すブロック図である。

【図 2】 軸方向の内径が非直線的に変化している異形内径部を有する軸受構成部品の断面図である。

【図 3】 塗布ヘッドの一実施形態の断面図である。

【図 4】 異形内径部を有する軸受構成部品が設置された塗布ヘッドの一実施形態の断面図である。

【図 5】 異形内径部を有する軸受構成部品が設置された塗布ヘッドの一実施形態の斜視図である。

【図 6】 異形内径部を有する軸受構成部品を備えた流体動圧軸受の一実施形態の断面図である。但し、微小隙間は誇張して示してある。

#### 【符号の説明】

1 フランジ付シャフト

2 円柱部材

3 リング部材

4 スリーブ

5 軸受構成部品又は環状蓋部材

5 a 異形内径部

5 b、5 c 及び 5 d 軸受構成部品 5 の外周面、上端面及び下端面

6 カップ状ハブ

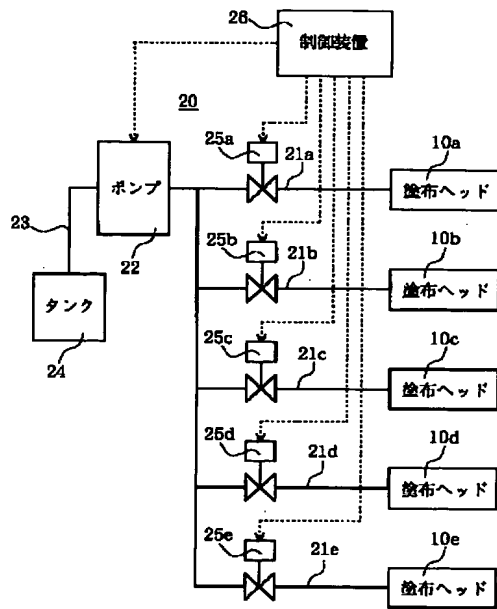
R1、R2、R3、R4、R5 微小隙間

F 潤滑油

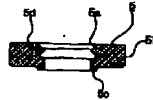
- 7  
10、10a～10e 塗布ヘッド  
11 本体部材  
12 柱状突起部又は円柱突起  
13 着座部又はオリング  
14 吐出口  
15 導通路  
16 保持部材  
17 排出路

- 18 空間  
20 撥油剤供給装置  
21、21a～21e 供給管  
22 ポンプ  
23 パイプ  
24 タンク  
25a～25e 電磁弁  
26 制御装置

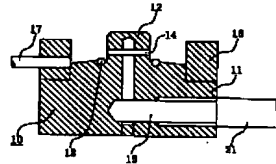
【図 1】



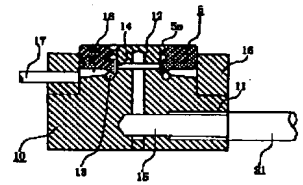
【図 2】



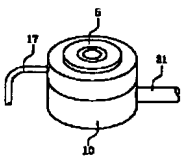
【図 3】



【図 4】



【図 5】



【図 6】

